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Stock-poisoning Plants of Western Canada

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- Only 12 to 15 kinds of poisonous plants are abundant and have a widespread distribution.
- Many of the poisonous plants have a short danger season.
- Poor pasture management is responsible for most livestock losses.
- Losses usually increase during drought because poorer quality feeds are eaten.
- Fewer losses will result if poisonous plants are recognized and avoided.

Stock-poisoning Plants of Western Canada

Robert W. Lodge,¹ Alastair McLean,² and Alexander Johnston³

Poisonous plants contain or produce poisonous substances that harm livestock. Depending on the poison and the amount of plant material eaten, an animal may die, may be disabled permanently, or may recover completely. Some plants cause immediate sickness or death after they have been eaten; for others it is several days before symptoms of poisoning develop. A few plants contain poisons that are excreted nearly as soon as they are eaten. These cause sickness or death when large amounts are consumed in a short time or on certain days. Other plants cause wounds or skin eruptions.

Poisonous plants are found in every ranching district. Fortunately, animals seldom eat poisonous plants except on overgrazed ranges or under unusual circumstances.

Poisoned animals are usually hard to treat. There is often no known antidote or none that can be given under range conditions. Usually the first intimation of poisoning is discovery of the dead animal, often in remote areas. The best way to avoid losses is to know the common poisonous plants. The most important poisonous plants are described in this publication.

Consult a veterinarian when stock die. He will determine the cause of death and you will be able to prevent further losses. If you suspect that a plant is poisonous, take or send specimens to your district agriculturist or nearest Canada Department of Agriculture research station. Positive identification can be made and control measures suggested.

PASTURE MANAGEMENT IN RELATION TO POISONOUS PLANTS

There are many poisonous plants, yet, with the exception of death camas, arrow-grass, and tall larkspur, few of them regularly cause death. Spectacular losses caused by poisonous plants are usually associated with one of the following abnormal conditions.

Overgrazing

Overgrazing causes good forage species to diminish in number and in size, and less palatable plants to increase. Therefore, to control poisonous plants and to reduce livestock losses, maintain a productive pasture.

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Date of Range Readiness

Pastures that are grazed too early in the spring, before the forage species have made much growth, will soon be overgrazed. If native pastures are grazed before they are ready for use, the earliest growing species must carry the grazing load. Death camas, choke cherry, and greasewood are some of the earliest range plants to show green leaves. On the prairies, livestock losses in early spring are usually caused by these species. In April and early May losses can often be traced to pasturing too early over ground infested with death camas. Losses of up to 10 lambs per day have been attributed to choke cherry that was eaten on overgrazed spring pasture in the Great Sandhills; when the flock was moved to choke cherry free pasture, the losses ceased.

Movement of Hungry Livestock

Movement of livestock at any season of the year, and particularly during the spring and early summer, gives the animals an opportunity to graze poisonous plants. When animals are moved, their grazing habits are disturbed. If they are hungry they are apt to eat large amounts of easily available forage and to graze plants that they refuse in their home pastures.

Drought

Losses from poisonous plants may increase during drought because lack of feed forces stock to eat any plant that is available. Losses from selenium poisoning occurred after the drought in the mid-thirties. In any seleniferous areas, when because of drought or other reasons it becomes necessary to feed poorer quality hay, livestock producers should carefully check their winter feed supply and be sure that the feed does not contain poisonous properties.

Irregular Occurrences

In some years certain poisonous plants are abundant. For example, in certain years when low larkspur is abundant, it can result in stock losses; in other years when it is sparse, livestock losses are rare. To reduce losses, maintain good pasture management practices. If possible remove stock from infested areas during the short growing season of low larkspur or watch the herd carefully, and treat affected animals immediately.

CONTROL OF POISONOUS PLANTS

Control of poisonous plants by methods other than pasture management is not practiced widely. Grubbing is a practical way to eradicate water hemlock and tall larkspur, and it is used on some ranches and in PFRA community pastures. However, all other species have such a wide distribution that grubbing is impractical. Where death camas and low lark-

spur are troublesome, eradication by cultivation followed by reseeding of grasses or grass-legume mixtures is suggested if soil and climatic conditions are suitable. Although the cultivation of extensive range areas to develop a summer pasture may not be warranted, cultivation and reseeding of selected areas for spring pasture is economical. This practice increases pasture production and provides range that is free of poisonous plants.

In Western Canada only a small amount of work has been attempted with herbicides for the control of poisonous plants. Because the native sward is a complex mixture of forages and weeds, and because many herbs and shrubs are valuable forage plants, heavy feed losses may follow the use of herbicides. Two years after death camas sites were treated with Atlacide at the Range Experiment Station, Manyberries, Alberta, few grasses had reestablished themselves, camas plants were abundant, and cactus had invaded the plots. Applications of herbicides heavy enough to kill pasture weeds affect the seed setting of native grasses and reduce the numbers of certain palatable broad-leaved plants.

MAJOR TROUBLEMAKERS

ARROW-GRASS

Triglochin maritima L.

Description—Arrow-grass is an erect, rushlike or grasslike perennial marsh herb, 6 to 30 inches tall. It is clumped and unbranched. The leaves are basal, shorter than the flower stalks, and grow from a base covered with sheaths of old leaves. The new leaves are rushlike, thick, flat on one side and rounded on the other, spongy inside, smooth, shiny, and bright green. The flowers are small and greenish, and clustered along spikelike flower stalks. The seed pods are three-sided, about $\frac{1}{4}$ inch long, lobed, and oblong.

Distribution and habitat—Arrow-grass is common in salt marshes and alkaline sloughs throughout Western Canada. It grows with sedges, rushes, and slough grasses.

Conditions of poisoning—This plant starts to grow earlier in the spring than the associated grasses and it has a more rapid regrowth than these grasses after it has been mowed. Therefore, it is more dangerous at these times, although stock may eat it readily at other times for its salt content. Both the green forage and the hay are toxic. Stored hay, however, gradually loses its poisonous quality. Cattle are most often affected but sheep are also susceptible.

Toxic principle—Hydrocyanic acid or prussic acid is produced from fresh or dried leaves in certain groups of plants (cyanogenetic) by the mixing of two nonpoisonous substances, a glucoside (amygdalin) and an enzyme, normally found separately in these plants. When the normal growth of these plants has been retarded or stopped by drought, frost, mowing, or other causes, these two substances mix because the plant cells break down



Figure 1. Arrow-grass.

and release hydrocyanic acid. Older parts of the plants (stems and dried portions) generally contain much less potential acid than the active young leaves, but they often retain toxic amounts. The poison is not cumulative.

Symptoms and lethal dose—The symptoms are rapid or deep breathing, muscular spasms, and convulsions at short intervals. Death follows from asphyxia or, if the dosage is heavy, from respiratory paralysis.

As little as 5 pounds of plants containing 0.5 percent potential hydrocyanic acid could be fatal if eaten over a short period of time.

Treatment—The effect of poisoning is usually too rapid for treatment. Good results have been obtained in cattle and sheep by intraperitoneal injections of sodium nitrite and sodium thiosulphate.

Another species, marsh small arrow-grass, *Triglochin palustris* L., is sometimes found in marshy places throughout Western Canada but is not nearly so common. It has been found in abundance in the lower Cariboo district in British Columbia, and losses have been attributed to it there.

DEATH CAMAS

Zygadenus gramineus Rydb.

Description—Death camas is a member of the lily family. It is a small (8 to 16 inches tall), slender, perennial herb with smooth, basal yellowish-green, grasslike leaves, 1/8 to 1/3 inch wide, V-shaped in cross section, and thicker than those of grasses. The many creamy-yellow flowers are about 3/10 inch long, lilylike and borne on short stalks along the main spikelike stem. Three upright capsules (1/4 to 3/4 inch long) per flower bear the numerous seeds and are joined together at the base and open lengthwise to allow the seeds to escape. The plant grows from a dark-coated bulb, which resembles an onion and is 1 to 1½ inches long. The bulb is generally 3 to 5 inches below ground. The plant reaches grazing height early in the spring, before most of the grasses. It flowers in May and early June. Seeds are formed in three-lobed capsules about 1/3 to 1/2 inch long during the latter part of June and early July, after which the plants quickly die back and disappear. Death camas may be confused with the wild onion, which, however, has pink flowers, a round head, and onion odor.

Distribution and habitat—Death camas is common in Saskatchewan and Alberta. The usual habitat is in upland draws and depressions. Death camas is generally scattered over the range. As it seldom occurs to the exclusion of other species, it is hard to control.

Condition of poisoning—Since the plants reach grazable height before most grasses, they are most dangerous during the spring. All parts of the plant are poisonous, especially the bulbs. The plant is particularly dangerous when the soil is wet, since the bulbs may be easily pulled up. Cattle may be poisoned early in the spring before green grass is available and the soil is wet, but it is mostly sheep that are poisoned.



Figure 2. Death camas.

Toxic principle—The poisonous principle is a group of steroid alkaloids.

Symptoms and lethal dose—Symptoms of poisoning by death camas are increased rate of breathing, excessive salivation, and nausea, which often lead to vomiting, and afterwards staggering and finally prostration. Animals may remain in a coma for hours or even days before death. Body temperature is increased during initial stages but it drops to below normal upon onset of the coma and remains there until death occurs. A lethal dose is considered to be 2 to 2.5 pounds of the green weight of the plant per 100 pounds of body weight. The seeds are especially poisonous; 0.10 pound is enough to cause the death of a mature cow. The plant is also toxic in the dried state and is poisonous in hay.

Treatment—Subcutaneous administration of atropine sulphate and picrotoxin is recommended early in the poisoning stage. It is most important to recognize the plant and to keep animals away from it.

Two other species of camas occur in the area but they are not widespread. The conditions of poisoning and the effects on stock are similar to those of death camas.

MEADOW DEATH CAMAS

Zygadenus venenosus S. Wats.

Description—Meadow death camas is similar to death camas.

Distribution and habitat—This species occurs in the range area of British Columbia at elevations up to 4000 feet and is found principally on moist grassy hillsides and draws in the fescue grassland zone in fairly rich well-drained soils.

WHITE CAMAS

Zygadenus elegans Pursh

Description—White camas resembles death camas in appearance but is considerably taller (2 feet) and more robust. The leaves are $\frac{1}{4}$ to $\frac{1}{2}$ inch broad and bluish green. The flowers are larger ($\frac{1}{2}$ inch across), greenish or whitish cream, more scattered along the main stem, and often on branched stalks.

Distribution and habitat—This species is found throughout Western Canada but it is not common. It prefers moist locations in rich well-drained soils.

TALL LARKSPUR

Delphinium glaucum S. Wats.

Description—Tall larkspur, a member of the buttercup family, is a tall stately perennial forb with stems 2 to 6 feet tall. The leaves are toothed, deeply cleft into three to five main lobes, alternate on the stem, with short hairs on one or both sides; the lower leaves are 3 to 6 inches in diameter and round in outline. The flowers are pale blue to purplish and



Figure 3. Tall larkspur.

have a characteristic spur. The fruit is composed of three upright compartments, each opening lengthwise to allow the many seeds to escape. The roots are long, fibrous, and woody. The plant starts to grow shortly after the snow melts.

Tall larkspur is often confused with monkshood and sticky geranium. The flowers of monkshood are hooded and those of sticky geranium are pink and not on long stalks.

Distribution and habitat—Tall larkspur has not been reported from Manitoba or southern Saskatchewan, but it is common in the foothills of the Rocky Mountains and the central interior of British Columbia. It grows in moist draws and on hillsides at higher elevations. It needs some shade and fairly rich well-drained soil.

Toxic principle—The alkaloid delphinine, which has a paralytic action on the heart and respiratory organs, is the chief poison.

Symptoms and lethal dose—The symptoms of poisoning are nausea, weakness, muscular twitching, and convulsions with drooling at the mouth. Animals fall down repeatedly. Death or recovery usually occurs rapidly.

If an animal eats as little as 0.7 percent of its weight of young plants it will die. Cured plants usually are not toxic, except for the seeds, which are seldom eaten in a quantity that will cause trouble.

Treatment—Medicinal treatment can be used, but, to be effective, it should be started very soon after poisoning has occurred. An affected animal should be kept quiet with its head up hill. Subcutaneous injections of physostigmin salicylate, pilocarpin hydrochloride, or strychnine sulphate are beneficial if the animal is not unduly excited by treatment.

LOW LARKSPUR

Delphinium bicolor Nutt.

Description—Low larkspur is a member of the buttercup family. It is a beautiful, somewhat pubescent native perennial forb, with stems up to 18 inches high. The leaves are mostly basal, alternate, deeply divided into a number of linear segments, up to 2 inches in diameter, and round in outline. The flowers are up to 1 inch across, blue to purple, with a long ($\frac{1}{2}$ to $\frac{3}{4}$ inch) spur at the bottom. There are few to 15 flowers on short stalks along the main flowering stem. The fruit is similar to that of tall larkspur, but is covered with short fine hairs. The plant starts growth in early spring, generally before most of the grasses. Blossoms appear in May and early June, and seeds are formed in the latter part of June or early July, after which the plants quickly die back and disappear. Menzies larkspur, *Delphinium menziesii* DC., is a similar species, which is usually found west of the Coast Range of British Columbia.

Distribution and habitat—Low larkspur has not been reported from Manitoba, but it is common in the Wood Mountain area and the Cypress



Figure 4. Low larkspur.

Hills in Saskatchewan and at higher elevations in southern Alberta. In British Columbia, it is widespread in the fescue grasslands of the interior, generally from about 2600 to 3000 feet elevation. It is locally abundant in openings in woodlands and sheltered areas.

Toxic principle—Delphinine is the chief poison. Other related alkaloids such as delphisine, delphincidene, and strophicagroine are also present.

Conditions of poisoning—Because the plants reach grazable height before most grasses, they are dangerous during the spring. All parts of the plant are poisonous. Low larkspur is grazed readily by both cattle and sheep, but sheep are seldom poisoned by it.

TIMBER MILK-VETCH

Astragalus miser Dougl. ex Hook. var.
serotinus (Gray) Barneby

Description—Timber milk-vetch is a member of the pea family and has the characteristic pea flower and pod. It is a long-lived, attractive, fragile, taprooted plant that grows in tufts from 8 to 16 inches tall. It is fine stemmed with compound pinnate leaves that carry 7 to 13 small ($\frac{1}{2}$ to $\frac{3}{4}$ inch), slightly hairy oval-shaped leaflets. The pinkish-mauve flower is generally from $\frac{1}{4}$ to $\frac{1}{2}$ inch long, with few to many along the flower stalk. Timber milk-vetch flowers from about mid-June, through July, and into August at higher elevations. The seed pod is $\frac{3}{4}$ to 1 inch long. The small black or greenish seeds mature between mid-July and mid-August and are shed soon after.

Distribution and habitat—In British Columbia timber milk-vetch occurs in the fescue grasslands; in the western yellow pine, lodgepole pine, and Douglas-fir forests of the Cariboo and Chilcotin regions; and in the Thompson, Nicola, Okanagan, Similkameen, Kettle, and Columbia-Kootenay valleys. A few plants have been found in the foothills of the Rocky Mountains west of Calgary. Within its range the species is found on most upland soil types but generally on fairly rich, light-textured, well-drained soils. Where it occurs, timber milk-vetch is common to abundant and is scattered over large areas, which makes local control difficult.

Conditions of poisoning—Observations at the Research Station, Kamloops, show that lactating cows are most seriously affected, but dry cows and male stock also have been poisoned. Suckling calves seldom show signs of poisoning. Some ranchers have observed that first calf cows show the highest percentage of poisoning. The same animals may be poisoned year after year. There is usually a greater incidence of poisoning during dry years, but this is probably caused by shortages of feed rather than increased toxicity.

Most poisonings occur while the plant is in the flowering stage. At the Research Station, Kamloops, in the early spring when herbage was



Figure 5. *Timber milk-vetch.*

abundant, cows avoided timber milk-vetch growing in bluegrass-clover pastures. They began to eat timber milk-vetch in July when the pastures were heavily grazed and the timber milk-vetch was in the late-flowering stage. In a herd of 17 cows, 6 out of 12 lactating cows showed typical poisoning symptoms but none of 5 dry cows was affected.

Toxic principle—The toxic principle is unknown. Selenium was suspected for some time but tests at the Research Station, Kamloops, show that this is not the causative agent.

Symptoms and lethal dose—Symptoms of poisoning are incoordination of hind legs, arching of the back, partial paralysis when excited, and difficulty in respiration accompanied by a protruding tongue, nasal discharge, and a roaring or wheezing sound. Frequent urination is a common symptom. Although emaciation is usually a symptom, animals that come down quickly with the disease remain fat. Death does not usually follow poisoning and most animals recover slowly.

Animals fed milk-vetch as the sole source of nutrients showed signs of poisoning after consuming 4 to 5 pounds. Cured plants do not appear to be toxic.

Treatment—Inject thiamine hydrochloride intramuscularly at 400 mg per 100 pounds of body weight. Move affected animals to areas where milk-vetch is not prevalent and where good forage and fresh water are provided so that they will recover their strength. If affected animals are too weak to travel, treat them with thiamine and give them feed and water until they gain enough strength to be moved.

WESTERN WATER HEMLOCK

Cicuta douglasii (DC.) Coult. & Rose

Description—Western water hemlock is a tall (2 to 6 feet), rather pale-green, branching, smooth, perennial forb of the carrot family. The stems are stout, hollow, and jointed, and often have purplish spots. The leaves are generally doubly compound and alternate; the leaf-stem bears a number of smaller leaf-stems with oval leaflets along each side. The leaflets have saw-toothed edges. The flowers are small and white, in compound umbrellalike heads. The fruit is small and round, splits when mature, and is dill-like, with prominent corky ribs. The plant blooms during June and July, but the fruits do not mature until late in the season. The base of the stem is generally somewhat enlarged and characterized by hollow chambers divided by horizontal cross portions. The rootstocks are short and tuberous, and they exude a yellowish, aromatic, extremely poisonous oil. Western water hemlock is probably the most poisonous plant of the region.

Distribution and habitat—This plant occurs in marshy sloughs, meadows, wet draws, and stream banks in grasslands and forested areas throughout Western Canada.



Figure 6. *Western water hemlock.*

Conditions of poisoning—Although the bulk of the poisonous oil is concentrated in the tuberous roots, enough is present in the young shoots to cause trouble. Also, the tubers are more likely to be pulled out and eaten while the ground is soft. Because of the pulling action of their grazing, cattle are most likely to be affected. However, all classes of stock and even humans have been poisoned. The dried tops are not generally toxic.

Toxic principle—The toxic principle is a resinous substance called cicutoxin.

Symptoms and lethal dose—The early symptoms are frothing at the mouth, uneasiness, and pain, and then violent convulsions, which cause the animal to kick, bellow, and groan.

A single root can kill a cow. The stems and leaves are much less poisonous.

Treatment—Treatment is not usually possible. Morphine injections may be used to aid in controlling the convulsions and a purgative may help in eliminating the poison.

Western water hemlock may at times be confused with poison hemlock, *Conium maculatum* L. However, poison hemlock is a tall (2 to 6 feet), much-branched biennial, with smooth, stout, hollow stems that have distinct purple spots. The leaves of poison hemlock are doubly compound, alternate, and deeply cut, similar to parsley. When crushed, the fresh leaves have a strong parsnip odor and a nauseating taste. The flowers are small and white, in compound umbrellalike heads. The fruit is small and round, and resembles dill. The taproot is large, white, parsniplike and nonchambered. Poison hemlock is rare in Western Canada. While it requires adequate moisture, it is not semiaquatic like water hemlock. Symptoms of poison hemlock are loss of appetite, excessive salivation, bloating, great pain, and rapid feeble pulse. Convulsions do not occur.

Western water hemlock also resembles the nonpoisonous water parsnip, *Sium suave* Walt. It can generally be distinguished from water parsnip by the tuberous, very oily rootstocks and enlarged, more distinctly chambered stem base. The leaves of water hemlock consist of an unbranched leaf-stem with only one series of elongated leaflets arising from it. The stem base of water parsnip is not enlarged, although it may be somewhat chambered. A small amount of oil may exude from a cut stem base.

Western water hemlock somewhat resembles the nonpoisonous cow-parsnip, *Heracleum lanatum* Michx., and angelica, *Angelica arguta* Nutt. However, cow-parsnip is generally more robust and has much broader, hairy leaflets and much larger flower heads.

The leaf veins of angelica end at the tip, whereas in western water hemlock the leaf veins end near the notches of the leaflets. The flowers of angelica may be white or yellow. The roots or stem bases are often not



Figure 7. Poison hemlock.



Figure 8. Upper, Water parsnip; lower, *Angelica*.

so enlarged as those of western water hemlock and have a more prominent taproot. They may have small chambers and exude a small amount of oil.

NARROW-LEAVED MILK-VETCH

Astragalus pectinatus Dougl.

Description—Narrow-leaved milk-vetch is an erect or semierect, much-branched herb that grows from 1 to 2 feet tall. The leaves are compound pinnate with 11 to 21 very narrow leaflets $\frac{1}{2}$ to 3 inches long. The flowers open in early June. There are 5 to 20 very noticeable cream-colored flowers $\frac{3}{4}$ to 1 inch long on each of several racemes. The seed pods are woody, oblong, elliptical, and $\frac{1}{2}$ to $\frac{3}{4}$ inch long.

Distribution and habitat—This plant is found in southwestern Manitoba, southern Saskatchewan, and southern Alberta on open prairies and roadsides, usually on lighter soils.

Conditions of poisoning—Milk-vetches usually indicate that the soils in which they are growing have a high selenium content. Milk-vetches absorb inorganic selenium and may have as high as 8000 ppm of this mineral in their tissues. Poisoning occurs most often in late summer or fall.

Toxic principle—Selenium, a nonmetallic element is the poison.

Symptoms and lethal dose—There are two forms of selenium poisoning. The acute form is commonly known as “blind staggers.” This usually occurs when animals are brought from nontoxic areas into areas where there is exceptionally toxic vegetation. Animals lose muscular coordination and move about restlessly, bumping into fences of corrals.

In the chronic form, animals lose their appetite and get thin. Their hooves become deformed and may drop off. There is a general loss of hair, particularly about the tail, and sores develop. Reproduction is impaired and animals may be sterile.

Treatment—Remove animals from the area or provide supplemental feed known to be free of or low in selenium.

Two-grooved milk-vetch, also poisonous, is another common species that is somewhat different in appearance, and more restricted in its distribution.

TWO-GROOVED MILK-VETCH

Astragalus bisulcatus (Hook.) A. Gray

Description—Two-grooved milk-vetch is a stout, many-stemmed, erect plant, 1 to 3 feet high. It has a distinct, unpleasant odor. The leaves have 17 to 27 elliptic leaflets $\frac{3}{8}$ to 1 inch long. The flowers are showy, deep purple, about $\frac{1}{2}$ inch long, and grow in long, dense racemes at the ends of long stems. The seed pods are $\frac{1}{2}$ to $\frac{3}{4}$ inch long, and have two deep grooves along one side.



Figure 9. Upper left, *Narrow-leaved milk-vetch*; upper right, *Two-grooved milk-vetch*; lower, *Early yellow locoweed*.

Distribution and habitat—This plant is very common throughout southern Saskatchewan and Alberta. It is usually found on semimoist sites. It may be abundant in new road ditches. Heaviest stands occur on shallow soils covering shale.

SECONDARY TROUBLEMAKERS

EARLY YELLOW LOCOWEED

Oxytropis macounii (Greene) Rydb.

Description—This species is a member of the pea family. Early yellow locoweed is low growing. The leaves are composed of 7 to 21 oval leaflets $\frac{1}{2}$ to 1 inch long, which have silky or short hairs. The flowers are yellow, and $\frac{5}{8}$ to $\frac{3}{4}$ inch long. Lower conjoined petals have a characteristic sharp erect point at the tip. The seed pods are about $\frac{3}{4}$ inch long, and are covered with short hairs, mostly white, but a few black. It is a showy plant, very noticeable in early spring. There are other locoweeds with yellow, cream, or purple flowers; all have the sharp erect point on the lower petals.

Distribution and habitat—Early yellow locoweed and several other poisonous locoweeds are found throughout Western Canada and in various habitats. Suspected plants should be taken or sent to the nearest Canada Department of Agriculture research station for identification.

Conditions of poisoning—Locoism, caused by this plant, is uncommon today but it was fairly common in early settlements.

Toxic principle—A substance, locoine, has been isolated from certain locoweeds and shown to cause characteristic symptoms.

Symptoms and lethal dose—Animals become listless and passive, and exhibit irregularities in gait and eating. In the latter stages of the disease, animals eventually stop eating and they die.

Treatment—Remove animals from infested areas and give them palatable and nutritious feed until they recover.

CHOKE CHERRIES

Prunus spp.

Description—Choke cherries are tall (up to 30 feet), deciduous shrubs of the rose family. The small white flowers grow thickly in terminal clusters. The leaves are smooth and simple, with a toothed edge. The fruits are small, red or purplish, and have a bitter, astringent taste and a stonelike seed. Flowering generally occurs in May and June; the fruit remains on the shrub until late fall.

Distribution and habitat—Several species of choke cherry occur throughout Western Canada. The shrub is common in moist draws and creek banks and grows best in lighter soils.



Figure 10. Upper, *Choke cherry*; lower, *Pursh's silky lupine*.

Conditions of poisoning—The plant is somewhat unpalatable to stock and is taken only when other forage is unavailable and animals are hungry. It is poisonous at all growth stages but most poisonous in the spring and early summer. The toxicity of the plant varies considerably, depending on the conditions under which the animals are grazing and the amount of poison that has accumulated in the leaves.

Toxic principle—Hydrocyanic (prussic) acid is the toxic substance (see arrow-grass for a description of the toxic principle and its action).

Symptoms and lethal dose—Uneasiness, staggering, convulsions, and difficulty in breathing are the first symptoms. Death follows bloating, usually within an hour of eating the leaves.

Treatment—Animals die so soon after eating the plants that treatment cannot usually be given. Drenches of potassium permanganate or glucose may be of benefit. Sodium nitrite and sodium thiosulphate therapy should be tried.

PURSH'S SILKY LUPINE

Lupinus sericeus Pursh

Description—Silky lupine is a beautiful, rather stout, taprooted perennial forb. It grows as high as 2 feet and is somewhat bushy in appearance. The foliage is silvery green because of the dense covering of short, fine hairs on the stems and leaves. Five to eight leaflets, which arise from the top of the leaf stem, present a palmlike appearance, since they are fairly long (up to 2 inches) and narrow. The leaf stems are alternate on the stalk. The many flowers are blue, about $\frac{1}{4}$ to $\frac{1}{2}$ inch across, and distinctly pealike. They have short stalks and are arranged in dense clusters along the spikelike stem. The fruit pod is about 1 inch long and densely covered with short, silky hairs. The taproot is fairly long and forms a crown, as in alfalfa. The plant blooms in June and July and the seeds mature in July and August. The plant remains green throughout the growing season.

Distribution and habitat—The silky lupine occurs in fescue prairie in southwestern Alberta, and in the fescue grasslands and yellow pine zones in the interior of British Columbia. It is found on open grassy hillsides, generally in rich, light, well-drained soils. It is common to abundant and is scattered over large areas, which makes local control difficult.

Conditions of poisoning—The seeds and pods of lupines are the most poisonous parts, but the leaves may cause trouble if large quantities are eaten at one time. Most poisonings occur when hungry stock, usually sheep, are turned onto infested areas.

Toxic principle—The poisonous principles are alkaloids of the lupanine group. The poison is not cumulative and is excreted if a lethal dose is not ingested at one time. The quantity of alkaloids present varies considerably according to soil type, soil fertility, and climatic conditions.

Symptoms and lethal dose—Poisoning causes heavy labored breathing which is followed by coma or frenzy, frothing at the mouth, and violent spasms. When poisoned by lupine, sheep will butt anything in their way. There is a great deal of cerebral congestion evident with this poisoning.

Sheep can safely eat up to 20 pounds of the leaves but $\frac{1}{2}$ to $1\frac{1}{2}$ pounds of the seed pods and seeds are likely to cause death. This plant is also toxic in hay and care should be exercised in feeding such material.

Treatment—No specific remedy is known. If used early, potassium permanganate may be useful as a chemical antidote. Morphine and other sedatives are useful.

Another less common lupine is the silvery lupine. Its poisonous characteristics and the treatment are the same as for silky lupine.

SILVERY LUPINE

Lupinus argenteus Pursh

Description—Silvery lupine is similar to Pursh's silky lupine, but as the hairs on the stems and leaves lie flat the plants appear less woolly. Flowers are light violet or purplish to almost white.

Distribution and habitat—Silvery lupine is plentiful in Cypress Hills and the foothills of the Rocky Mountains, and is not uncommon throughout southern Alberta along the Milk River Ridge.

GREASEWOOD

Sarcobatus vermiculatus (Hook.) Torr.

Description—A much-branched shrubby perennial with spiny branches, it may grow to 5 feet, but a height of 2 to 3 feet is more common. The leaves are pale yellowish green, thin, and about 1 to $1\frac{1}{2}$ inches long. The very small male and female flowers are borne separately. The male flowers are in small spikes at the ends of the stems; the female flowers are borne singly in the axils of the leaves. The seed is surrounded by a broad membranous wing.

Distribution and habitat—Greasewood is found only in the southern part of Alberta and Saskatchewan on strongly saline flats.

Conditions of poisoning—Lambs are the animals most subject to greasewood poisoning. The losses occur soon after flocks are moved to summer range, when the animals are hungry and are in unfamiliar surroundings. Sheep and calves have also been poisoned by greasewood.

Toxic principle—The buds and young leaves of greasewood contain salts of oxalic acid.

Symptoms and lethal dose—Intake of greasewood causes depression, weakness, shallow pulse and breathing, and collapse. The lethal dose is unknown but it appears to be very small.



Figure 11. Upper left, *Greasewood*; upper right, *Horsetail*; lower left, *Bracken fern*; lower right, *Monkshood*.

HORSETAILS, SCOURING RUSHES

Equisetum spp.

Description—The horsetails are well-known, nonflowering perennial herbs. The aerial stems are rushlike, ridged, jointed, generally hollow and single, ending in a cone or with whorls of four-angled, fine, green branches; they are from 8 to 24 inches tall. They contain a rather large amount of silica, which makes them very harsh. The leaves are very small and scale-like, forming a cylindrical sheath at the nodes or joints of the stems.

Distribution and habitat—These plants are common in moist fields, swales, and meadows throughout Western Canada, especially in flood plains and sandy soil. They are a common component of native meadow hays.

Conditions of poisoning—Horses, mainly, are affected, especially by eating hay that contains much horsetail. It seldom seems to cause trouble in pasture.

Toxic principle—Recent experiments have failed to implicate the components previously believed toxic. At present the poisonous factor is unknown.

Symptoms and lethal dose—Symptoms of the poisoning are unthriftiness, loss of weight, and gradual weakening of the animal. After an animal has fed on horsetail for two to five weeks, it loses muscular control, falls down, and struggles violently to get up. The animal is usually willing to eat but is unable to rise and finally dies of exhaustion. Grain-fed animals are able to resist the action of the poison better than animals not fed grain. The symptoms may be slow to develop, as the speed of development depends upon the age of the animal and the amount of horsetail in the hay.

Treatment—Immediately stop feeding hay that contains horsetail. Give a purgative and bran mashes to assist in removing the poisonous plant from the digestive tract.

Horsetail occurs most commonly in poorly drained fields. To eliminate or reduce the hazard, provide good drainage, then cultivate and reseed the fields.

BRACKEN FERN

Pteridium aquilinum (L.) Kuhn

Description—Bracken fern is a tall (1 to 4 feet), coarse perennial herb. The aboveground parts of the plant, the fronds, have the appearance of large, finely divided, broadly triangular leaves with a strong, somewhat woody central stem. The fronds develop by unrolling. The underside of the fronds is covered with fairly coarse brown hairs. The margins of the fronds are rolled under and lined with tiny, rust-colored spore cases. The plant reproduces by means of stout, black, woody rootstocks and from spores.

Distribution and habitat—Bracken fern is found only in eastern Manitoba, the Riding Mountains, and British Columbia. In British Columbia, it

is generally associated with western red cedar and western hemlock forests. It is locally common to abundant in upland pastures, abandoned fields, and forested and burned-over areas in high-rainfall regions where there are poorly drained gravelly or sandy soils.

Condition of poisoning—The plant is equally poisonous in green forage or in dry condition and therefore may be a problem in hay. Bracken is not palatable and generally will not be taken unless other forage is scarce. Cattle and, especially, horses are often affected by eating hay that contains much bracken.

Toxic principle—Poisoning is thought to be due to pteritannic acid, a substance similar to and probably identical with the filicic acid found in the male shield fern. Also, the thiaminase activity in the leaves and rhizomes of the plant varies in amount according to the season. When horses have been poisoned by bracken fern, their blood thiamine level drops, and their blood pyruvic acid level rises. The mechanism of poisoning in cows is not understood. Subcutaneous thiamine therapy is effective in horses but not in cattle.

Symptoms and lethal dose—Cattle that eat bracken fern often develop internal hemorrhages and other complications; death is caused by severe hemorrhage or secondary infection in lesions caused by consumption of the plant. Horses become somewhat stupefied, timid, and sleepy. No specific amounts are recorded for lethal dosage.

Treatment—A saline cathartic may assist in eliminating the poison. Give poisoned animals good feed and keep them quiet. When pasture is scarce, provide them with bulky feed.

MONKSHOOD

Aconitum columbianum Nutt.

Description—This plant belongs to the buttercup family and is closely related to the larkspur, which it resembles. It looks much like tall larkspur, but it can be distinguished by the hood or helmet formed by one petal over the rest of the flower in place of the spur. Roots of monkshood are short and tuberlike with yellowish rootlets, whereas those of tall larkspur are long and fibrous. The stem of monkshood is pithy while the stem of larkspur is hollow. The upper leaves of monkshood are close to the stem; those of larkspur have petioles or stalks.

Distribution and habitat—The plant has much the same distribution and habitat as that of tall larkspur, and often both are found growing together, though monkshood is much less common.

Conditions of poisoning—The plant appears to be most poisonous before flowering but it may cause poisoning anytime. The toxic principle is contained largely in the roots and seeds. Monkshood seldom causes trouble on the range, probably because it is seldom abundant.

Toxic principle—Toxicity is due to the alkaloid aconitine. The amount present depends largely upon conditions of growth.

Symptoms and lethal dose—Symptoms of poisoning are muscular weakness, irregular and labored breathing, weak pulse, bloating and belching, constant attempts at swallowing, and contraction or dilation of the pupils of the eyes. No information is available on amounts necessary to cause poisoning.

Treatment—No antidote is known. Drugs such as digitalin or atropine are given to stimulate breathing and to overcome depression of heart activity.

HEATHS

Ericaceae

Rustyleaf

Menziesia ferruginea Smith.

White-flowered rhododendron

Rhododendron albiflorum Hook.

Glandular Labrador tea

Ledum glandulosum Nutt.

Swamp-laurel

Kalmia polifolia Wang.

A number of shrubs of the heath family are poisonous to livestock. They are grouped together because they have somewhat similar growth habits, distributions, toxic principles, and symptoms of poisoning.

Descriptions—Rustyleaf is a medium-sized (3 to 15 feet) branching shrub with thin, alternate leaves, which have scattered rusty hairs on the upper surface. The flowers are greenish purple, rather small, and borne in terminal clusters.

Glandular Labrador tea is a low shrub with fairly thick leaves that are resin-dotted underneath, which make the herbage fragrant when bruised. The flowers are small, yellowish white, and borne in terminal clusters.

White-flowered rhododendron is also a medium-sized shrub with thin, clustered leaves. The flowers, one to three in a cluster, are showy, pale yellow, bell-shaped, and about 1 inch across.

Swamp-laurel is a somewhat smaller (1 to 2 feet), branching, ever-green shrub, with oblong, leathery, opposite leaves that are dark glossy green above and whitish beneath. The leaf margins are rolled under. The flowers are small, lilac-colored, and borne in terminal clusters.

Conditions of poisoning—Sheep are most commonly affected, since the plants are seldom grazed by cattle unless other feed is short and since most of the localities where these plants are found are used as sheeprange. Because the leaves of most of these species are leathery or bitter, their palatability is rather low.

Distribution—These poisonous species occur commonly in British Columbia and the eastern Rockies in Alberta. They have similar distributions and are found in moist forest zones. Swamp-laurel and glandular



Figure 12. Upper left, *Rustyleaf*; upper right, *Glandular Labrador tea*; lower left, *White-flowered rhododendron*; lower right, *Swamp-laurel*.

Labrador tea are found mostly in wet meadows and bogs. Rustyleaf and white-flowered rhododendron occur more on uplands, in moist woods.

Toxic principle—The toxic principles of these plants are not well known, but the substance andromedotoxin is suspected of causing poisoning.

Symptoms and lethal dose—Symptoms are salivation, an increased flow of secretions from the nose, convulsions and paralysis of limbs, emesis (possibly bile-stained), and dehydration.

Treatment—Remove animals from infested areas, and give them laxatives, demulcents, and nerve stimulants.

MUSHROOMS

Livestock may be poisoned by certain mushrooms, although this is uncommon in Western Canada. However, when mushrooms are abundant, stock may develop a taste for them and eat considerable quantities. These animals will become emaciated from poor nutrition rather than from poison.

WESTERN YELLOW PINE

Pinus ponderosa Dougl.

Description—Western yellow pine is a coniferous tree. Under average range conditions it grows 70 to 80 feet high. The dark-green needles are 7 to 11 inches long, and they occur in bundles of two to five needles — usually three. The tree has a characteristic reddish-orange platy bark.

Distribution and habitat—It is a chief component of the vegetation of the subhumid region of southern interior British Columbia.

Conditions of poisoning—Under certain conditions yellow pine needles may cause either nutritional or mechanical abortion. The problem areas are confined to the yellow pine belt of the interior valleys of the Fraser, Nicola, Thompson, Similkameen and Okanagan rivers, eastward along the international boundary to Nelson and the southern portion of the Rocky Mountain Trench.

Toxic principle—The Research Station, Kamloops, has undertaken a series of studies to determine whether or not pine needles cause abortion. The results are inconclusive, but tests show that pine needles may be a cause of abortion, depending on the stage of pregnancy (cows that are 7 to 8 months pregnant appear to be most susceptible), the level of feed intake, the time of year when the needles are eaten, and the amount consumed.

Treatment—The bred cow herd should be wintered in areas free of yellow pine. If this is impossible, the lower branches of the trees should be pruned and the pasture cleared of fallen trees after storms. Discontinue logging operations in pastures where bred cows are grazed, since cows will nibble on the slash even when adequately fed.

MECHANICALLY INJURIOUS PLANTS

Cheat grass or downy brome	<i>Bromus tectorum</i> L.
Needle grass or spear grass	<i>Stipa comata</i> Trin. & Rupr.
Red three-awn	<i>Aristida longiseta</i> Steud.
Wild barley or wild foxtail	<i>Hordeum jubatum</i> L.
Wild oats	<i>Avena fatua</i> L.
Lesser burdock	<i>Arctium minus</i> (Hill) Bernh.
Prickly-pear cactus	<i>Opuntia</i> spp.

These common plants, although not poisonous, occasionally cause considerable injury to livestock. They have sharp seeds, awns, or spines that may work their way into the tongues, gums, eyes, noses, or skins of animals. Extreme discomfort or inflammation results and the animals go off feed and lose weight and condition. Sores, besides causing discomfort, may be the source through which pathogenic bacteria enter the tissues or circulatory systems and cause local or general infections. The fibers of plants such as wild barley may ball up and lodge in the stomach or intestines.

NITRATE POISONING

Common forage plants can cause livestock poisoning. Oat hay or straw is the most common cause of nitrate poisoning. Barley and wheat straw, corn, flax, sorghum and other forages, and weeds, chiefly lamb's-quarters, have been found to contain toxic quantities of nitrate. High levels of fertilization with nitrogen fertilizers may result in high nitrate levels in common grasses.

Conditions of poisoning—Nitrate poisoning is most common when feed, particularly immature oats, has suffered drought late in the growing season. Forage crops from areas, such as feedlots and cattle yards, where manure has accumulated for long periods of time may be dangerous. Many common weeds can cause nitrate poisoning. Lamb's-quarters is particularly dangerous and should never be fed to livestock. Hay from shady areas on high-nitrogen soils may be dangerous, as nitrate accumulation increases with increased shading. Animals on poor feed are more susceptible to nitrate poisoning. This susceptibility can be reduced by the inclusion in the ration of concentrates with a high carbohydrate content. However this treatment may be precluded by the fact that animals will usually prefer the feeds high in nitrates, and unless care in management is exercised the animals will still ingest excessive amounts of the high nitrate feed.

Toxic principle—When plants with a toxic amount of nitrate are consumed by livestock, a conversion of nitrate to nitrite takes place in the intestinal tract. This nitrite is absorbed into the bloodstream, where it

combines with the hemoglobin, the oxygen carrier in the blood, to form methemoglobin. Methemoglobin does not combine with oxygen and when large quantities of it are present, the oxygen-carrying capacity of the blood is reduced to the extent that the animal dies of anoxia, which is similar to carbon monoxide poisoning.

Because of the rapid course of the illness, nitrate poisoning may be confused with anthrax, clostridial diseases such as blackleg or malignant edema, or pasteurella infection such as hemorrhagic septicemia.

Symptoms and lethal dose—Typical symptoms of nitrate poisoning in cattle include restlessness, frequent passing of urine, and extreme weakness. The blood becomes dark brown. Finally the animals collapse, sink to the ground, roll on the side, and die quietly without a struggle. Post-mortem shows hemorrhages and inflamed areas on the surface of the rumen and small intestines. Forages with over 0.34 to 0.45 percent nitrogen in the nitrate form are potentially toxic.

Treatment—Intravenous injection of a 1 to 4 percent aqueous solution of methylene blue should be given at the rate of 2 g methylene blue per 500 pounds of animal body weight. Because of its irritant properties, methylene blue should not be allowed to escape into the tissues surrounding the vein.

POSSIBLE TROUBLEMAKERS

The following plant species, which occur commonly within the ranching areas of the western provinces, are reported to have caused poisoning among stock in other regions. Although no losses from these plants have been brought to our attention, ranchers should watch them carefully and report any losses so that they can be investigated by local authorities.

Black nightshade, *Solanum nigrum* L., is a much-branched, somewhat spreading annual that has oval-shaped leaves with pointed tips and wavy margins. The clustered whitish flowers resemble those of a potato. The berries are round, smooth, green; they turn black when mature. The plant is a weed that grows in moist fields and waste places, including areas around corrals and barnyards, especially on lighter soils. It does not normally grow on areas with a perennial plant cover.

Corydalis, *Corydalis* spp., is a medium-sized biennial, with yellow- or rose-colored flowers and smooth, often silver-tinged, deeply cut leaves. It closely resembles bleeding heart, *Dicentra*. It occurs commonly in moist, open woods, but seldom in concentrations sufficient to cause trouble.

Dogbane, *Apocynum* spp., is a perennial, creeping-rooted, erect, branching forb. It has broad, opposite leaves, and clusters of small, pink bell-shaped flowers that produce long, slender pods containing numerous

seeds with tufts of silky hairs. The stems and leaves contain a milky juice. Dogbane is commonly found on abandoned fields, waste places, dry meadows, and open wooded areas. It generally occurs on sandy or gravelly soils.

Field buttercup, *Ranunculus* spp., is a tall (1 to 3 feet), hairy, perennial, yellow-flowered buttercup with round, divided leaves. It is common in pastures, meadows, along streams, and waste places where sufficient moisture is available.

St. John's-wort, or goatweed, *Hypericum perforatum* L., is an unpalatable, perennial, which grows from 1 to 3 feet tall. It has small leaves pitted by small glands in the under surface. The yellow flowers occur in clusters and develop into many-seeded brown capsules. The plants spread by strong underground rootstocks and often invade even lightly grazed grassland ranges. The plant causes photosensitivity in white-skinned animals. When photosensitized animals are exposed to sunlight, their skin becomes sensitive, sores and swellings develop, and loss of weight and condition result from poisoning. Recovery is speeded by changing feed and keeping the animals out of direct sunlight.

Horsebrush, *Tetradymia canescens* DC., is a low, spreading, pale-green to gray shrub with soft, needlelike leaves, and deep-yellow flowers in clusters. It closely resembles and generally grows with rabbitbrush. Known only in British Columbia, it seldom occurs in sufficient abundance to cause trouble. The plant is occasionally found on moderately dry grasslands on lighter soils.

Showy milkweed, *Asclepias speciosa* Torr., is an erect, showy, perennial herb that has strong, creeping rootstocks. The leaves are generally wide, somewhat leathery and woolly, and they contain a milky juice. The flowers are pinkish mauve and are clustered in round heads at the stem tips. The fruits are large, with thick coats enclosing numerous reddish-brown seeds, each with tufts of long silky hairs attached. The plants may be locally common in moist locations, pastures, abandoned fields, and similar areas throughout Western Canada.

Lady's-thumb, *Polygonum* spp., has oval or lanceolate leaves, and pale-pink flowers in erect spikes. There is a membranous sheath at the junction of leaf and stem. It is locally common in shallow water or near the margins of sloughs and meadows. It is usually associated with a mixture of grasses and sedges. If eaten when green, it can cause photosensitization in animals.



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CONVERSION FACTORS FOR METRIC SYSTEM

Imperial units	Approximate conversion factor	Results in:
LINEAR		
inch	x 25	millimetre (mm)
foot	x 30	centimetre (cm)
yard	x 0.9	metre (m)
mile	x 1.6	kilometre (km)
AREA		
square inch	x 6.5	square centimetre (cm ²)
square foot	x 0.09	square metre (m ²)
acre	x 0.40	hectare (ha)
VOLUME		
cubic inch	x 16	cubic centimetre (cm ³)
cubic foot	x 28	cubic decimetre (dm ³)
cubic yard	x 0.8	cubic metre (m ³)
fluid ounce	x 28	millilitre (mℓ)
pint	x 0.57	litre (ℓ)
quart	x 1.1	litre (ℓ)
gallon	x 4.5	litre (ℓ)
bushel	x 0.36	hectolitre (hℓ)
WEIGHT		
ounce	x 28	gram (g)
pound	x 0.45	kilogram (kg)
short ton (2000 lb)	x 0.9	tonne (t)
TEMPERATURE		
degree fahrenheit	°F-32 x 0.56 (or °F-32 x 5/9)	degree Celsius (°C)
PRESSURE		
pounds per square inch	x 6.9	kilopascal (kPa)
POWER		
horsepower	x 746 x 0.75	watt (W) kilowatt (kW)
SPEED		
feet per second	x 0.30	metres per second (m/s)
miles per hour	x 1.6	kilometres per hour (km/h)
AGRICULTURE		
bushels per acre	x 0.90	hectolitres per hectare (hℓ/ha)
gallons per acre	x 11.23	litres per hectare (ℓ/ha)
quarts per acre	x 2.8	litres per hectare (ℓ/ha)
pints per acre	x 1.4	litres per hectare (ℓ/ha)
fluid ounces per acre	x 70	millilitres per hectare (mℓ/ha)
tons per acre	x 2.24	tonnes per hectare (t/ha)
pounds per acre	x 1.12	kilograms per hectare (kg/ha)
ounces per acre	x 70	grams per hectare (g/ha)
plants per acre	x 2.47	plants per hectare (plants/ha)

Examples: 2 miles x 1.6 = 3.2 km; 15 bu/ac x 0.90 = 13.5 hℓ/ha

